



Topics in Computer Science: Theory of Computation

CSCI 440

SEMESTER (Spring 2014)

PROFESSOR/CLASS INFORMATION

Shieu-Hong Lin

(Course) Title: Topics in Computer Science
Theory of Computation

Term: Spring, 2014

Location: Busn 210

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Course Code/#: CSCI 440TC

Class Days/Time: MW 1:30-2:45pm

Credit Hours/Units: 3

Office Location: White 48

Meetings with Professor: Make Appt via Email

Admin Assistant: Jerrienne Smith, x4741

Class Website: <http://csci.biola.edu/csci440TC>

DISABILITY SERVICES

Disability Services exist to assist any student who thinks he or she may need such assistance. Students desiring accommodations for this class on the basis of physical learning, psychological and/or emotional disabilities are to contact The Learning Center which houses both learning assistance and disability services. The Learning Center is located in the Biola Library, Upper Level, Room U-137, and this department can be reached by calling 562.906.4542 or by dialing extension #4542 if calling from on campus.

NON-DISCRIMINATION POLICY

As Christian scholars, we are keenly aware of the power of language, and believe in treating others with dignity. As such, it is important that our language be equitable and prejudice free. Good writing and speech do not make unsubstantiated or irrelevant generalizations about personal qualities such as age, disability, economic class, ethnicity, marital status, parentage, political or religious beliefs, race, sex, or sexual orientation. Respectful use of language is particularly important when referring to those outside of the religious and lifestyle commitments of those in the Biola community. By working toward precision and clarity of language, we mark ourselves as serious and respectful scholars, and we model the Christ-like quality of invitation.

Avoid the use of stereotypes or terminology that demeans persons or groups based on age, disability, ethnicity, gender, race, language or national origin. Avoid drawing attention to irrelevant identifiers of race or gender. Avoid gender-specific language when referencing people in general. Avoid terms that assume the universality of human experience, and in particular presume the normativity of the socially dominant group.

BIOLA UNIVERSITY MISSION STATEMENT

TRUTH~TRANSFORMATION~TESTIMONY

The mission of Biola University is biblically-centered education, scholarship, and service; equipping men and women in mind and character to impact the world for the Lord Jesus Christ.

SCHOOL OR PROGRAM MISSION/VISION STATEMENT

The Computer Science program at Biola endeavors to equip the students with the foundational understanding of the theories and practice of computing, the capability of effective problem solving based on the foundational understanding, and a holistic integration of faith and learning into their perspective of computing to impact the world for Christ.

COURSE DESCRIPTION

Concepts from theoretical computer science, finite state concepts, decidability, computability, and Turing machines. Offered every other year.

COURSE ALIGNMENT WITH PROGRAM LEARNING OUTCOMES

CSCI 440 Topics in Computer Science: Theory of Computation. This upper-division course is an elective course for computer science juniors and seniors. Successful completion of this course (see next section) will prepare students to demonstrate a developing proficiency toward the accomplishment of PLO: analysis, modeling and problem solving.

COURSE OBJECTIVES AND STUDENT LEARNING OUTCOMES

By the completion of this course including class participation, class assignments (referred to as "Tasks"), class readings and group interaction, the following objectives and learning outcomes will be assessed and demonstrated:

IDEA Objective #4: Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course (Essential emphasis).

STUDENT LEARNING OUTCOMES The learner will demonstrate that he or she has satisfactorily fulfilled IDEA Objective #4 by being able to:

- write programs using [Eclipse](#), a powerful programming language for [constraint logic programming](#), and develop an in-depth understanding of the syntax and semantics of logic programming and the roles of constraint processing and search in problem solving,

- analyze constraint satisfaction problems, model the problem-solving schemes as Eclipse logic programs, and solve the problems by the search capability provided by Eclipse,
- understand logic and its important applications in automatic deduction, formal verification, and problem solving, and
- gain a solid understanding of computational complexity such as the concepts of complexity classes [P](#), [NP](#), [NP-hard](#), and [NP-complete](#) and the implications of whether [P=NP](#) in computation.

REQUIRED TEXTS

Required Textbooks (Each of the following books are required and will be used in this course)

- Krzysztof R. Apt and Mark, [Constraint Logic Programming using Eclipse](#), Cambridge University Press, 2007.
- Antoni Niederlinski, [A Gentle Guide to Constraint Logic Programming via ECLiPSe](#), J.S. Computer Studio. (Available free online from the author).

ACADEMIC HONESTY

Biola University is committed to ethical practice in teaching, scholarship, and service. As such, plagiarism and other forms of academic dishonesty will not be tolerated. Please see the undergraduate/graduate student handbook and/or the departmental/program/school policy on academic honesty. It is imperative that you present all written, oral, and/or performed work with a clear indication of the source of that work. If it is completely your own, you are encouraged to present it as such, taking pleasure in ownership of your own created work. However, it is also imperative that you give full credit to any and all others whose work you have included in your presentation via paraphrase, direct quotation, and/or performance, citing the name(s) or the author(s)/creator(s) and the source of the work with appropriate bibliographic information. To do otherwise is to put oneself in jeopardy of being sanctioned for an act or acts of plagiarism that can carry serious consequences up to and including expulsion from the university.

<http://studentlife.biola.edu/campus-life/student-handbook/academic-integrity>

<http://plagiarism.org/plagiarism-101/overview/>

ONLINE AND OTHER COURSE RESOURCES

Throughout the academic term, any number of hard-copy documents or various other resources (electronic or otherwise) may be made available to students registered for this course. Those resources may be presented in class or could alternately be posted on Biola's Blackboard system or in the electronic reserves area of the library's catalog for viewing and download. It is the student's responsibility to make himself or herself aware of such materials, and to electronically save, physically print, archive, read, reference, and bring such items to class as necessary or required.

These course resources may include, but are not limited to, syllabi, rubrics, worksheets, protocols, and the like. Prior to and after the beginning of the term, students should take responsibility to periodically check the course site on the university learning management system. This will ensure he or she is in

possession of all necessary items for the successful completion of course objectives. If failing to have such items on hand affects the student's participation in class, s/he should anticipate that reality impacting her/his participation score and, potentially, final grade. To access online materials that may be available, log on to <http://blackboard.biola.edu>.

In addition, the Biola Library's website at <http://library.biola.edu> provides access to thousands of electronic books and journal articles for your research.

LEARNING TASKS (Assignments) & ASSESSMENT (Grading)

Description and Weighting of Assignments:

Task 1: Weekly Reading and Progress Report

Due Date: Wednesday of the week (15 assignments)

Weighting: 15%

Possible Points: 3 points each.

Description: Using the template for cumulative weekly progress report, the student needs to incorporate information such as the amount of time he/she spent for the reading, attendance, and the overall progress in reading, programming, and other assignments since last Wednesday into the cumulative progress report.

Assessment: The student need to (i) finish the reading on time and record it in the progress report (1 point), (ii) attend the class this week (1 point), and (iii) gain a good understanding of 80% or more of the contents or have spent at least three hours in the reading (1 point).

Task 2: Weekly Programming Assignments (10 assignments)

Due Date: Wednesday of the week

Weighting: 45%

Possible Points: 6 points each.

Description: There will be 9 weekly programming assignments, which form the backbone of the course. They require the student to incrementally develop programming skills based on the concepts of data structures and object-oriented programming learned in the class.

- Peer discussion is most encouraged, but any copy-and-paste code from other people's programs is absolutely prohibited and will lead to serious discipline actions.
- Peer discussion based on the code shown on the screen and paper could be very helpful for debugging purpose and explanation of ideas. But you should **never pass around your code as electronic files** to others except for the TA and the instructor.
- You should make sure that **you are able to reconstruct your code from scratch without any outside help** when you submit a programming assignment as your own work.

Assessment: The student needs to email the source code files (all related .cpp and .h files) together with a self-evaluation report to the TA. We'll grade each programming assignment in a 0-6 scale based on the following rubric.

1. Source code is completed but the code fails to compile successfully.
2. Source code can compile and do something required, but has serious bugs or miss a couple of key features.

3. Source code can compile and do most of the features required, but has many minor bugs or miss a key required feature.
4. Source code can compile and do all the features required, nearly fully functional, only a couple of minor bugs.
5. Source code can compile and do all the features required, fully functional, no bugs.
6. In addition to the points received above, get one more point if the source code is well indented and commented to make it visually very readable.

Task 3: Exams (Quizzes, Midterm and final exams)

Due Date: Midterm and Final exam week

Weighting: 40%

Possible Points: Up to 50 points each.

Description: The exams have both the written component, which mainly tests the conceptual understanding of computation and logic, and the programming component, which tests skills in logic programming.

Assessment: The written component will be graded based on the answers provided while the programming component will be graded based on the same rubric provided for the weekly programming assignments.

CLASS INFORMATION

1. Class Attendance and Attendance Policy:

Attendance You are expected to attend the class regularly since we will examine details of logic programs using the computers in the lab. Missing the class may seriously hamper your understanding of many key concepts and programming skills critically needed in your programming assignments.

Policy Class attendance is counted toward points for the weekly progress report.

2. Assignments:

Due dates of various assignments will all be on Wednesdays. In order to get full credit for an assignment, you must send it in by the end of the day on the due date. Late submission up to 6 days late will end in a deduction of **15%** of the total points **each day**. Assignments turned in 7 or more days late will receive no point.

3. Turning in Assignments:

Assignments are expected to be received electronically by email with a clear subject title indicating it is for a specific CSCI 440 assignment.

4. General Requirements for Written and Oral Projects:

Biola University desires to maintain the highest standards with respect to the composition of all (written /oral/performed/etc.) work. As such, any student (paper/project/presentation/etc.) exhibiting (a statement about your philosophy and/or policy regarding mechanical errors, etc.)

Students deficient in writing skills may seek assistance at the Biola Writing Center which is located on the middle level of the Biola Library. All written work within the (your Department Name) should follow the (Style Manual, if appropriate).

5. Professional Courtesy (A statement such as the following may be used, adapted, or not included.)

Students are expected to uphold the highest standards of courtesy and professionalism to the professor, classroom guests, and fellow collegians. This includes the employment of institutional and academic titles when addressing faculty, administrators, and other university personnel or classroom guests. Classroom dress, proper grooming, behaviors, and hygiene should be such that they are not distracting or offensive to classmates or dishonoring to the Lord Jesus Christ and this institution.

6. Respect for Divergent Viewpoints (Although not a required syllabus component at this time, it is highly recommended that you consider including some statement such as the following)

In Christian higher educational institutions, it can be assumed that each believer-learner is at a different place of personal maturity and educational preparedness. For these reasons, it is requested and expected that each student exhibit mutual respect, even when divergent viewpoints are expressed in the classroom. Such respect, even when it results in a student's frustrated silence, does not require or imply agreement with or acceptance of any such perspectives.

7. Technology Use and Classroom Etiquette (Although not a required syllabus component at this time, it is highly recommended that you consider including some statement such as the following example)

Students should refrain from behaviors that negatively affect the teaching environment or its facilities. This includes any potentially distracting action that could inhibit the primary purposes of the classroom— namely, learning and personal transformation. Students should conduct themselves as professionals who give, and are worthy of, a high level of respect. Material presented in the classroom represents the intellectual property of the professor and of others who may have contributed to the professor's perspectives. Class meetings may not be recorded by audio and/or video without the express consent of the professor.

The use of items like laptops, pagers, cell/mobile phones, mp3 players, and all other electronic or digital devices are matters that are strictly governed in academic environments such as this. Neither the professor nor one's classmates should expect to endure buzzing, vibrating, ringing, singing, or other intended/not intended but nevertheless distracting noises from your device(s). With the exception of laptops (which are to be used solely and strictly for educational purposes directly related to what is happening moment by moment in this class) and other similar note-taking devices, students are expected to take the initiative and choose either not to bring such devices or to fully power down each of these items prior to the beginning of class and to keep them off until class is dismissed. Students who fail or forget to turn off communication devices and who receive such communications should expect to be reproved by the professor during class. Incidents like these are frowned upon and cannot be tolerated for the integrity of the learning atmosphere.

In addition, it is expected that students not participate in distracting activities such as e-mailing, web-surfing, instant messaging, and computer gaming during class. The professor is alert to

such disturbances and if/when such activities are discovered, the student should expect to be confronted and asked to leave for the remainder of the immediate class session (morning/afternoon, or until a break, etc.), and then counted absent for that time period while not in class. Appropriate deductions will be taken for any missed class participation or required course work due during that period of time. Simply put, under no circumstances will the professor excuse a student's inappropriate behavior, academic apathy, or general indifference to subject matter that this institution considers necessary for effective vocational preparation—nor will the professor allow other students interested in being equipped to endure a disinterested, distracting university student. **The professor uses the most powerful language possible about these matters due to the egregious nature of these distractions. If the spirit or the letter of these guidelines is violated by students, the professor reserves the right to completely restrict the use of all electronic and battery-powered devices, including laptops/computers, during class, however unfortunate that would be.**

8. Computation of Final Grade:

Weekly Progress Report	15 %
Weekly Programming Assignments	45%
Exams	40 %
Total	100%

9. Final grades will be awarded on the following point system:

A	93%
A-	90%
B+	87%
B	84%
B-	80%
C+	77%
C	74%
C-	70%
D+	67%
D	64%
D-	60% to pass class

GENERAL INFORMATION

1. The GPA System used by the University Registrar's Office is:

A = 4.0	B = 3.0	C = 2.0	D = 1.0
A- = 3.66	B- = 2.66	C- = 1.66	D- = 0.66
B+ = 3.33	C+ = 2.33	D+ = 1.33	F = 0.0

2. Method of Instruction:

The following methods of instruction will be included in this course:

(You may select from the following list and/or add other methods relevant to your course)

1. Lecture
2. Group Discussion
3. Written Reports
4. Programming Assignments
5. Electronic Presentation
6. Use of the Internet
7. Other Audio/Visual Resources
8. Reading
9. Digital and/or Print Media

3. Posting of Grades:

Grades for individual assignments will be posted under Biola's Blackboard system. To access the records online, log on to <http://blackboard.biola.edu> to make sure the records are accurate.

4. Report Delay:

In virtually every case that students do not meet the course requirements and when required course tasks are not submitted to the professor, such students should anticipate receiving a failing grade. In rare and unusual situations (e.g., serious illness of the student or illness or death in a student's immediate family), the student may formally request a report delay (RD) through the Vice Provost's Office. Details can be found in the student handbook.

<http://studentlife.biola.edu/campus-life/student-handbook/absences>

5. Course Calendar

While the course calendar is intended to provide you with an overview of the semester's schedule, the professor reserves the right to make adjustments to the schedule to responsively meet the needs of this class.

Tentative Schedule

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| • Week 1 | Logic programming and pure Prolog |
| • Week 2 | A reconstruction of pure Prolog |
| • Week 3 | Arithmetic in Prolog |
| • Week 4 | Control and meta-programming |
| • Week 5 | Manipulating structures |
| • Week 6 | Constraint programming: a primer |
| • Week 7 | Iteration in ECLiPSe |
| • Week 8 | Top-down search with passive constraints |
| • Week 9 | The suspend library |

- Week 10 Constraint propagation in ECLiPSe
- Week 11 Top-down search with active constraints
- Week 12 Optimization with active constraints
- Week 13 Constraints on reals
- Week 14 Linear constraints over continuous and integer variables
- Week 15 Applications
- *Final*